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AUTHOR Calvert, Sandra L.; And Others
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ABSTRACT

Preplays (critical material presented before a televised program) were inserted before three sections of a televised story to determine if they would improve children's attention and comprehension by providing overall plot structure for selecting and integrating important story events. The preplays varied on two orthogonal dimensions: presence or absence of visual events and concrete or inferential story narrative. In same-sex pairs, 160 first through fourth grade students saw an animated television story with or without preplays. A control group saw no preplays. Each child's visual attention to the television screen was recorded continuously. After viewing, the children ordered four pictures and then answered multiple choice questions assessing recognition of implicit, central-concrete, and incidental content. Results indicated that preplays facilitated attention, which, in turn, predicted comprehension of visually presented information. Older children attended longer to inferential preplays and performed better on the implicit comprehension task, while younger children attended longer to concrete preplays. The inferential narration was effective as an aid to comprehension, but only when it was within a child's range of comprehensibility. Findings suggest that television producers can use preplays to improve comprehension, but effectiveness reflects the match between a child's cognitive level and the information processing demands of the presentation. (Author/FL)

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Improving TV Program Comprehensibility: Developmental Effects of Visual and Verbal Production Features

Sandra L. Calvert

Children and Technology Project

Department of Child Development and Family Relations

University of North Carolina at Greensboro

Greensboro, North Carolina 27412

Aletha C. Huston and John C. Wright

Center for Research on the Influences of Television on Children

Department of Human Development

University of Kansas

Lawrence, Kansas 66045

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Improving TV Program Comprehensibility: Developmental Effects of Visual and Verbal Production Features

Abstract

Preplays were inserted before three sections of a televised story to improve children's attention and comprehension by providing an overall plot structure for selecting and integrating important story events. Preplays varied on two orthogonal dimensions: presence or absence of visual events and concrete or inferential story narration. A control group saw no preplays. In same-sex pairs, 160 first through fourth graders viewed an animated TV story with or without preplays. Each child's visual attention to the television screen was recorded continuously. After viewing, children ordered four picture sets and then answered 42 multiple-choice items assessing recognition of implicit, central-concrete, and incidental content. Visual preplays facilitated attention which, in turn, predicted comprehension of visually presented information. Older children attended longer to inferential preplays and performed better on the implicit comprehension task while younger children attended longer to concrete preplays. The inferential narration was effective as an aid to comprehension, but only when it was within a child's range of comprehensibility. Producers of children's television programs can utilize preplays to improve comprehension, but effectiveness reflects the match between a child's cognitive level and the information processing demands of the presentation.

Children's comprehension of television programs may be affected by the symbol systems that are used to present, structure, and organize content (Huston & Wright 1983; Salomon 1979). In particular, media such as television present content through visual and verbal symbol systems which parallel the iconic and symbolic modes which children can use to represent content (Calvert, Huston, Watkins & Wright 1982). The purpose of this study was to examine a production technique designed to organize televised information schematically through visual and verbal symbol systems in order to maximize children's iconic and symbolic processing and recall of significant story content.

Children enjoy televised stories, but their comprehension of critical story content develops more slowly than does their understanding of incidental, peripheral content (Collins 1975). Even small preschoolers can understand important television content in programming specifically designed for them (Lorch, Anderson & Levin 1979), but through middle childhood comprehension difficulties occur when children view adult programming (Collins 1975; 1982). These difficulties include selecting critical plot-relevant content for processing, organizing that content into a story scheme, and reasoning by which a viewer temporally integrates discrete program content and infers character feelings and motives (Collins, Wellman, Keniston & Westby 1978).

The relative emphasis of visual versus verbal formal production features as codes to represent story content may partly explain young children's information processing difficulties. Formal features are visual and auditory production techniques

that are the distinctive symbol system of television (Salomon 1979; Wright & Huston 1983). A viewer must be able to decode this symbol system in order to understand a televised story (Rice, Huston & Wright 1982). Children's programs contain high levels of perceptual visual and auditory formal features such as action and sound effects to transmit story messages whereas adult programs rely heavily on verbal dialogue to convey messages (Huston, Wright, Wartella, Rice, Watkins, Campbell & Potts 1981).

Visually presented information may often be processed iconically while verbally presented information may more often be processed symbolically. For example, visually presented character actions are related to improvements in picture sequencing (Beagles-Roos & Gat 1983); recognition of visually presented events (Calvert et al. 1982; Hayes & Birnbaum 1980; Welch & Watt 1982); and visually-based inferences (Beagles-Roos & Gat 1983; Meringoff 1980); while verbally presented information is related to recognition of expressive language and inferences based on a broader, personal knowledge base (Beagles-Roos & Gat 1983; Meringoff 1980). Young children's reliance on visual over verbal features for information selection may explain their fragmented processing of television programs (Hayes & Birnbaum 1980), particularly when verbal measures are used to assess comprehension of information that has been stored in a visual modality.

Salomon (1979) suggests that young children may need to transform verbal messages into nonverbal iconic representations for effective comprehension while older children can more easily

process verbal messages directly. For example, Calvert et al. (1982) found that ten-year-old children recalled central televised content well when it was presented only through dialogue whereas five-year-olds did not. However, kindergartners did understand central content when dialogue was presented simultaneously with moderate levels of character action. Similarly, comprehension of prose text is facilitated when relevant pictures are provided for younger children, but older children do not need such aids (Guttmann, Levin & Pressley 1977). Apparently visual emphasis on verbal content requires a young child to make fewer mental elaborations than when verbal content is presented alone (Salomon 1979). Thus, a young child does not have to transform verbal information into a preferred iconic modality and may rely on the presentation to supplant that mental activity.

An alternative but closely aligned hypothesis suggests that information processing is easier when dual rather than single symbol systems present content (Freidlander, Wetstone & Scott 1974). This implies that verbal supplements should also support processing of visually presented information. This thesis is supported by increases in comprehension when televised visual events are verbally summarized and integrated during the presentation (Collins, Sobol & Westby 1981; Watkins, Calvert, Huston-Stein & Wright 1980) or verbally rehearsed after the presentation (Freidrich & Stein 1975). Verbal labeling not only improved young children's comprehension of the specific implicit relationships labeled (Collins et al. 1981), but of the more general implicit program events (Watkins et al. 1980). However, verbal

labeling that only described character actions did not improve comprehension (Collins et al. 1981). Thus, young children's recall benefits from verbal supplements only when information is provided that would not be spontaneously produced by children (Collins 1982).

Nonetheless, language is not well attended to when it is beyond a child's range of comprehension. For example, preschoolers are more likely to attend to a television program that presents concrete dialogue about immediately present visual events than to one containing abstract dialogue about events that are removed in time and place (Anderson, Lorch, Field & Sanders 1981). If children make attentional decisions based on program comprehensibility (Anderson et al. 1981; Lorch, Anderson & Levin 1979), then concrete narration should be more attention-worthy to a young child while abstract narration should be more attention-worthy to an older child, and this variation in attention, in turn, may lead to differential comprehension.

Verbal rehearsal preserves content already presented and correspondingly facilitates recall. Visual rehearsal may well function the same way. Visual rehearsal could be designed to provide an overall plot structure which integrates and connects important thematic action by increasing temporal continuity in the presentation. Temporal connections among logically related events improve young children's understanding of story structure and organization while temporal separation interferes with comprehension. For instance, Collins (1973) reported that third graders chose more aggressive responses after viewing a televi-

sion program with a commercial interruption between a violent action and its punitive consequence than when those events were not interrupted. Presenting important visual events in temporal proximity may increase the probability that a child will perceive those events as causally related.

An analogous benefit might be realized by "prehearsal," that is, by active forward processing that anticipates, rather than recapitulates, story content. Stories improve the memorability of events by including temporal and causal structural elements which facilitate schematic memory organization (Mandler 1979). Mandler (1979) describes a schema as a preexisting cognitive structure which guides the comprehension process through anticipation of important events. One may think of a schema as having slots in which one "fills in" available information. Research in story grammars (Stein & Glenn 1979) and in television (Collins 1982; Wright, Huston, Ross, Calvert, Rollandelli, Weeks, Rae'ssi & Potts in press) suggests that young children are less likely to have an efficient memeory scheme for selecting, encoding, and retreiving story events than are older children. If forward prehearsal can guide a child's initial selection and encoding of information by supplanting a story scheme, then the probability is increased that a child will attend to and remember critical plot-relevant content.

With these ideas in mind, a new television format was adapted from the instant replay to structure information a priori for children. The format was named "preplay" because critical mate-

rial was played before a child saw the actual program. The purpose was to assess developmental differences in children's visual attention to, and comprehension of, a prosocial television program as a function of varying preplay formats. To determine which features were most effective as aids to comprehension, preplays were varied factorially on two dimensions: 1) presence or absence of visual portrayal of story events; and concrete or inferential story narration. Three sets of relationships were examined: 1) developmental differences in visual attention as a function of preplay features; 2) developmental differences in story comprehension as a function of preplay features; and 3) the relation between visual attention to preplays and comprehension of story content.

Visual preplays were expected to increase visual attention more than nonvisual preplays, particularly for young children. Older children were expected to attend more than younger ones to the most informative preplay feature--inferential narration. Visual preplays were expected to improve comprehension because a visual structural overview was provided that should facilitate encoding, temporal integration, and sequential retrieval of visual story events. Inferential narration was expected to improve comprehension of implicit content, particularly for older children who could understand abstract narration. By contrast, concrete narration was expected to improve comprehension of concretely presented central content, particularly for young children. For all children, visual attention to preplays was expected to predict comprehension of visually presented informa-

tion better than comprehension of verbally presented information.

Method

Participants

Subjects were 160 children equally distributed by sex in grades one through four. Children attended one of three schools which served a wide socio-economic status range.

Stimulus Program

The program was selected after a CBS evaluation revealed that 54% of the children in their sample did not understand the producer-intended message-- parents can remain friends after they are divorced (CBS 1974). The plot involved a child's problems with her parents' divorce. At first, Flora did not make friends with the kids at her new school. Because of her unfriendliness, Fat Albert's gang teased Flora and made her cry. When the gang realized that Flora was upset about her parents' divorce, they made her a present and put on a special show to make amends. Thus, Flora became friends with the gang. Nonetheless, the parental conflict continued and peaked on Flora's birthday. Flora ran away from home and was found by the gang at their clubhouse. The plot resolution occurred when her parents found them and realized that their continual arguments were making Flora unhappy. The program ending was unintentionally ambiguous about whether her parents remained divorced or remarried.

Five versions of the program were made. In all five, the cartoon plot was retained, but verbal summaries by Bill Cosby and commercials were deleted, leaving a mean program length of 14.5

minutes. The control stimulus contained no experimental additions. For the four experimental treatments, narrated "preplays" of central story information were inserted before each of the three program sections. The four preplay conditions were nonvisual-concrete narration, nonvisual-inferential narration, visual-concrete narration, and visual-inferential narration. Each set of preplays was three to five minutes long.

In nonvisual conditions, the camera showed a magical female fortune teller in a gypsy costume as she forecast the future story events. In visual conditions, the future story events were previewed through a visual special effect: a bubble popped on the screen beside the narrator and displayed central visual action sequences from the cartoon as she spoke. In concrete verbal conditions, the narrator simply described the ongoing flow of character actions. In inferential verbal conditions, she verbally integrated and elaborated the story theme by providing inferences about character feelings and by connecting character motives, actions, and consequences.

Same-sex pairs of children were taken from their classrooms to a mobile laboratory where they were seated opposite one another at a table. Across the room from them was a television monitor under a one-way mirror. On the table were small toys, comic books, and drawing materials. An experimenter told the children to read, play, and watch television as they did at home. She then went to an adjacent observation room and activated a videotape recorder which played the edited, color version of the program to which the pair had been randomly assigned.

Attention

Visual attention was scored "on" when a child looked at the television screen and "off" when a child looked away. Two observers seated behind a one-way mirror continuously scored attention with a Datamyte electronic recorder. Each recorded one child's visual orientation. Reliability was assessed by having two independent observers score the same child. Three children were scored for a total of 45 minutes. Agreement occurred when both observers coded an onset or offset within +2.4 seconds of one another. For each child, interobserver agreement was 97%.

The dependent measure was duration of attention, the percent of time that each child looked at the television screen. A duration score was computed separately to the three preplays and the three program segments. Because the control group did not see preplays, they had scores only for the three program segments.

Comprehension

Picture Sequence Scores. After viewing, each child accompanied an experimenter to separate mobile laboratory rooms where each child individually completed two types of comprehension items: picture sequencing and multiple choice. First, a child sequenced four sets of six photographs taken from the television program to assess temporal integration of the plot line. The first picture set represented central visual events from the entire program and included two pictures from each of the three preplays. Each of the remaining three picture sets represented one of the program sections summarized by the three preplays. These sequencing sets included four pictures shown and two not

shown in preplays.

For each picture set, the experimenter randomly arranged the six photographs in two rows. She then said, "Here are some pictures of things that happened in the story. I'd like you to put these pictures in order from the first thing that happened in the story to the last in a line right in front of you," (experimenter drew a straight line with her finger). After a child had ordered the photographs, the experimenter said either: "Now tell me what happened in the story," or "Tell me what happened in this part of the story."

A picture sequence score was calculated for each child by comparing the child's picture order to its correct absolute position and the number of correctly sequenced adjacent pictures. To do so, the pictures were correctly numbered from 1 to 6. For each picture, one point was awarded for every picture with a lower number placed to its left. In addition, one point was awarded for each correct adjacent pair of pictures. The total picture sequence scores were calculated by adding the two parts, resulting in a maximum possible score of 20. This scoring method is correlated about +.80 with rank order correlations between obtained and correct sequences but gives more credit for correct adjacent pairs (cf, Wright et al. in press).

Multiple-Choice Recognition. Each child then answered 42 multiple-choice recognition questions. The recognition memory test was designed to measure a child's comprehension of program content while controlling for possible age differences in verbal

ability. To construct test items, central and incidental events of the story were identified and put into an open-ended questionnaire by three adult judges who were familiar with the program. Next, 18 adults viewed the program, rated those questions as central or incidental to the plot, and answered the questions. Central elements were defined as information that was essential for understanding the story. Items with a minimum of 70% agreement were retained. Central questions involved either concretely presented facts or inferences about character feelings and motives, whereas incidental questions all concerned concrete information. For each question, one incorrect response was taken from the open-ended questionnaire. Parallel questions were constructed in two response formats: verbal response choices and verbal response supplemented with visual drawings of the answers. Thus, each of the 42 multiple-choice questions consisted of a picture, a question, and two response options presented in verbal and visual form or verbal form only. Each child completed half the items with visual and verbal response options and half with verbal response options only. The items presented in each format were counterbalanced for each pair of subjects.

The experimenter read each question aloud, and the child selected from alternatives that were color-coded as a red "A" or a blue "B". There were 13 implicit items, 8 central-concrete items, and 21 incidental items. The dependent variables were the number of correct items for each category. The total session lasted approximately one hour.

Results

To test the effects of preplay formats, analysis of variance was conducted for all seven dependent variables with visual presentation (2) x verbal narration (2) x grade (4) x sex (2) as between-subjects independent variables. Pairs was the unit of analysis for all effects. Two dependent variables were attention to preplays and attention to program segments. Duration of looking was computed separately for the three preplays and the three program segments. Preplay and segment became, in turn, a repeated measures factor in the analysis of attention. Two dependent variables were derived from picture sequencing: segment sequencing and whole program sequencing. The three picture sequence scores for the three program sections were treated as a repeated measures factor in the analysis of segment sequencing. The sequence representing whole program integration was analyzed separately. Recognition scores for comprehension of implicit, central-concrete, and incidental content were the remaining three dependent variables.

All five conditions, including the control group, were compared to assess the effects of presence or absence of preplays in a condition (5) x grade (4) x sex (2) analysis of variance. Finally, regressions of attention to preplays on each respective comprehension measure were calculated.

Effects of Visual Presentation

As predicted, children attended longer to visual than to nonvisual preplays, F (1,32) = 11.89, $p<.01$. Mean duration of attention was 42% in nonvisual conditions and 59% in visual

conditions. The effects of visual presentation on attention to the program segments were qualified by a visual x grade x program segment interaction, F (6,64) = 2.53, $p<.05$. See Table 1. Dun-

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Insert Table 1 about here
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can's multiple range follow-up test indicated that children were generally more attentive to program segments after seeing visual than nonvisual preplays.

As expected, children who saw visual preplays correctly sequenced more pictures from the segment sequencing task than did children who saw nonvisual preplays, F (1,32) = 4.86, $p<.05$. The means were 15.32 for children in visual conditions and 14.37 for children in nonvisual conditions. For whole program picture sequencing, treatment effects were qualified by sex, F (1,32) = 4.64, $p<.05$. As seen in Table 2, boys who saw visual preplays

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Insert Table 2 about here
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sequenced more pictures correctly than did boys who saw nonvisual preplays while girls did equally well in both conditions. There were no main effects of visual presentation on recognition scores.

Effects of Verbal Narration

The effects of verbal narration on attention were age dependent. As seen in Figure 1, with increasing grade there was a

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Insert Figure 1 about here
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developmental shift from an attentional preference for preplays with concrete narration to preplays with inferential narration. The interaction of verbal narration x grade x preplay was significant, F (5,64) = 3.53, p<.01. Fourth graders were very different in their attentional preference for inferential narration. The interaction of verbal narration x grade x program segment was also significant, F (6,64) = 2.67, p<.05. See Figure 2. Patterns

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Insert Figure 2 about here
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of attention established during the preplays were similar to patterns of attention to the program segments that followed them. In addition, for all age levels, a decline in attention to program segments occurred when preplays with inferential narration were presented nonvisually, but when inferential narration was presented with visual character actions from the story, high attentional interest was maintained across the program segments. Figure 3 depicts the interaction of verbal narration x visual presentation x segment, F (2,64) = 7.25, p<.001.

Insert Figure 3 about here

Verbal narration had no effects on segment sequencing. For whole program sequencing, a sex x verbal narration interaction occurred, F (1,32) = 4.39, p<.05. See Table 2. Boys in concrete narrative conditions sequenced more pictures correctly than did boys in inferential conditions while girls did equally well in both conditions.

As predicted, children in inferential narrative conditions

recognized more implicit content than did those in concrete narrative conditions, F (1,32) = 4.88, $p<.05$. Means were 10.92 for children in concrete conditions and 11.52 for those in inferential conditions. The improved recognition in inferential conditions reflected an accurate understanding of the final story outcome. Verbal narration had no effects on recognition of central-concrete or incidental content.

Comparison between Preplay and Control Groups

When the control group was included in the attention analysis, there was a condition x program segment interaction, F (8,80) = 2.46, $p<.05$. See Table 1. Fourth graders who saw preplays were more attentive to the program segments than were fourth graders who saw the control.

For segment sequencing, children in visual conditions performed better than children in nonvisual conditions, and scores for the control group fell between those means. For whole program picture sequencing, a treatment x sex interaction occurred, F (4,80) = 4.28, $p<.05$. Boys in the control condition sequenced more pictures correctly than did girls who, in turn, performed better than boys in the preplay conditions. See Table 2. The control and preplay groups did not differ on recognition items.

Developmental Differences

As expected, differences in children's attention and comprehension occurred as a function of age. Older children attended longer to preplays than did younger children, F (3,32) = 3.39, $p<.05$; they ordered more pictures correctly on whole program sequencing, F (3,40) = 8.34, $p<.001$; they ordered more picture

sets correctly on segment sequencing, F (3,40) = 4.32, $p<.01$; and they recognized more implicit, F (3,40) = 8.56, $p<.001$, central-concrete, F (3,40) = 3.06, $p<.05$, and incidental content, F (3,40) = 12.62, $p<.001$, than did younger children. A grade x sex interaction, F (3,40) = 4.99, $p<.01$, revealed that girls recognized more implicit content than did boys, but only at first grade. The means for first graders were 11.15 for girls and 9.4 for boys. There were no overall grade differences in attention to the program segments.

Attention as a Predictor of Comprehension

The final analyses assessed the unique contribution of visual attention to comprehension as indexed by picture sequencing and recognition. In the regression analyses, grade, sex, and condition effects were allowed to enter the equation before visual attention. Comparable analyses were also run with attention to the program segments as predictors of comprehension scores. Only the preplay analyses are reported since they were the major focus of the study, and results were very similar when attention to program segments was analyzed.

Visual attention to preplays predicted comprehension of visually presented information. More specifically, visual attention to the first and third preplays predicted 8% and 16% of the unique variance in comprehension of the two related sequencing sets. The standard regression coefficients were B=.29, F (2,61) = 11.04, $p<.001$, and B =.41, F (3,60) = 9.13, $p<.001$, respectively. Unexpectedly, attention to the third preplay predicted 12%

of the variance for the second picture set. The standard regression coefficient was B =.35, F (1,62) = 8.79, p<.01. Attention to the second preplay predicted 7% of the unique variance in whole program sequencing. The standard regression coefficient was B =.27, F(3,60) = 8.52, p<.001.

The only instance when attention predicted recognition of multiple-choice items was for incidental content. Attention to the first preplay predicted 7% of the unique variance for recognition of incidental content. The standard regression coefficient was B =.29, F (2,61) = 20.49, p<.001. Visual attention did not predict comprehension of verbally presented information as indexed by the implicit and central-concrete recognition items.

Discussion

Differences in children's visual attention to, and comprehension of, a prosocial television program were found as a function of varying preplay formats. Visual preplays were most attention-worthy, and that attention, in turn, facilitated temporal integration of targeted visual information. These findings suggest that the visual action in preplays facilitated a visual iconic mode of representation, thereby aiding reconstruction and organization of visually presented information. The visual overview seemed to provide a story scheme to integrate key visual events.

Contrary to prediction, visual features did not improve comprehension for younger children more than for older children. Instead, children through middle-childhood profited from visual

emphasis of significant content. These findings contribute to a growing body of knowledge indicating that visual action in television programs (Beagles-Roos & Gat 1983; Calvert et al. 1982; Morningoff 1980) and visual presentation in general (Cramer 1976) are useful as aids to comprehension even at older age levels.

Developmental differences were found in children's attentional patterns only as a function of verbal narration. Anderson et al. (1981) reported that preschoolers were more attentive to television when concrete rather than abstract narrative soundtracks were used, presumably because the concrete narrative track, which used simpler language and included visual referents, was more comprehensible. In this study, first and second graders were more attentive to preplays with concrete narration; third graders were transitional; and fourth graders demonstrated a strong attentional preference for inferential narration. Anderson and Lorch (1983) and Rice et al. (1982) suggested a curvilinear relation between attention and comprehensibility. When material is either too easy or too difficult to understand, it loses attention. Perhaps the inferential narration was challenging for fourth graders, and too difficult for second graders. This increased interest by fourth graders generated high levels of attention to the first two program segments. By contrast, second graders in inferential conditions dropped in attention to program segments compared to those in concrete conditions.

Concrete visual images may heighten visual attention even if the narration is difficult to understand because visual action provides iconic referents for the abstract, inferential lan-

guage. When visual presentation was combined with inferential narration, attention was longer than when the same narration was presented without visual emphasis. Moreover, information presented through dual symbol systems allows children to process content in visual, verbal, or both symbol systems.

As in previous television research (Calvert et al. 1981; Collins 1975), developmental differences favored older over younger children for all comprehension tasks. Collins (1982) has documented developmental differences in comprehension during grade school, and this data suggests that major changes in processing abilities occur around fourth grade. The cognitive skills that fourth graders had developed included the ability to translate a symbol system into a different modality, and the ability to process and encode inferential narration directly. If younger children depend on visual and concrete presentational characteristics for information processing, then they may be less likely to go beyond the information given to make inferences.

Preplays were also designed to supplant inferential reasoning skills for children who have difficulty drawing the implict relationships between explicitly presented central events (Collins et al. 1978; Salomon 1979). Inferential narration had a direct positive effect on children's comprehension of implicit story content, particularly the final story outcome. The implicit items included inferences that children made themselves as well as that which was labeled for them on the inferential narrative soundtrack. Prehearsal, as well as rehearsal (Collins et al.

1981; Watkins et al. 1980), then, can improve children's comprehension of implicit story content. Because preplays structured information before rather than after it was seen, children may have searched for significant information as they were viewing.

Sex differences indicated differential processing of abstract, verbal narration, particularly in the absence of visual emphasis. Previous television research (Collins et al. 1978; Freidrich & Stein 1976) found that girls process verbal information better than do boys during early grade school. In this study, girls were better able to use inferential nonvisual preplays to integrate central program material than were boys. By contrast, boys seemed to rely on concrete features of preplays to encode story information. Visual portrayal and concrete narration may be ways of providing boys with information that can be understood by visual processing and encoded by visual imagery.

The importance of a concrete presentation for successful performance is further demonstrated by boys' skills to integrate the whole program in the control condition. The control version had neither commercial nor narrative interruptions that are so common in commercial television programs. To increase plot drama, producers typically place commercials between significant plot actions and their related consequences, a practice that disrupts plot integration for young viewers (Collins 1982). Integration of events may have been improved simply by showing the program without interruptions, thereby improving the temporal continuity of the program. Thus, a simple way to improve temporal integration by young viewers may be to cluster commercials

only at the beginning and end of a program so that children can view causal story events closer together in time.

The final question concerned the relationship between visual attention and comprehension. Visual attention predicted comprehension of visually presented information, but not of verbally presented information. Comprehension of abstract verbal content is at least partly independent of visual attention, suggesting that either a viewer need only listen to understand it, or that other cognitive skills determine the ability to use what is seen. The concreteness of visuals may be an aid in that children attend to and understand character actions, but without knowledge of the verbal, symbolic information, comprehension may remain shallow. Deeper levels of processing occur only as children become more responsive to language.

In summary, this study suggests a developmental shift in children's ability to understand and encode inferential narration, an abstract, symbolic form of representation. The visuals, an iconic representational system, remain interesting, attention-worthy, and facilitate visual comprehension through middle childhood. In addition, the concrete emphasis of visual presentation seems to support processing of the more abstract and informative forms of language. Production techniques such as preplays can improve children's comprehension of plot-essential televised story content, but effectiveness depends on the match between the cognitive skills a viewer brings to the viewing situation and the information processing demands of the presentation.

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Table 1

Mean Duration of Attention to Program Segments as a function of Visual Presentation and Grade

	Nonvisual Presentation	Visual Presentation	Contro
Segment 1			
Grade 1	.49 b*	.50 b*	.59
Grade 2	.42 c*	.50 b	.49
Grade 3	.41 c*	.52 b*	.63
Grade 4	.63 a*	.68 a*	.39
All Grades	.49	.55	.53
Segment 2			
Grade 1	.56 b	.42 c*	.55
Grade 2	.34 c*	.50 b	.50
Grade 3	.39 c*	.52 b	.58
Grade 4	.58 b*	.66 a*	.47
All Grades	.47	.53	.53
Segment 3			
Grade 1	.55 b	.46 b*	.54
Grade 2	.31 c*	.50 b	.53
Grade 3	.37 c*	.49 b*	.65
Grade 4	.65 a*	.55 b	.51
All Grades	.47	.50	.56

Values with different letter superscripts are significantly different at $p < .05$.

* indicates values are significantly different from the control group at $p < .05$.

Table 2

Mean Correct Comprehension Scores on Whole Program Picture Sequencing by Presentation Mode and Sex

	Boys	Girls
Visual Presentation	17.50	17.53
Nonvisual Presentation	15.53*	17.94
Concrete Narration	17.38	17.44
Inferential Narration	15.66*	18.03
All Preplay Conditions	16.52*	17.24
Control Condition	17.69	15.25*

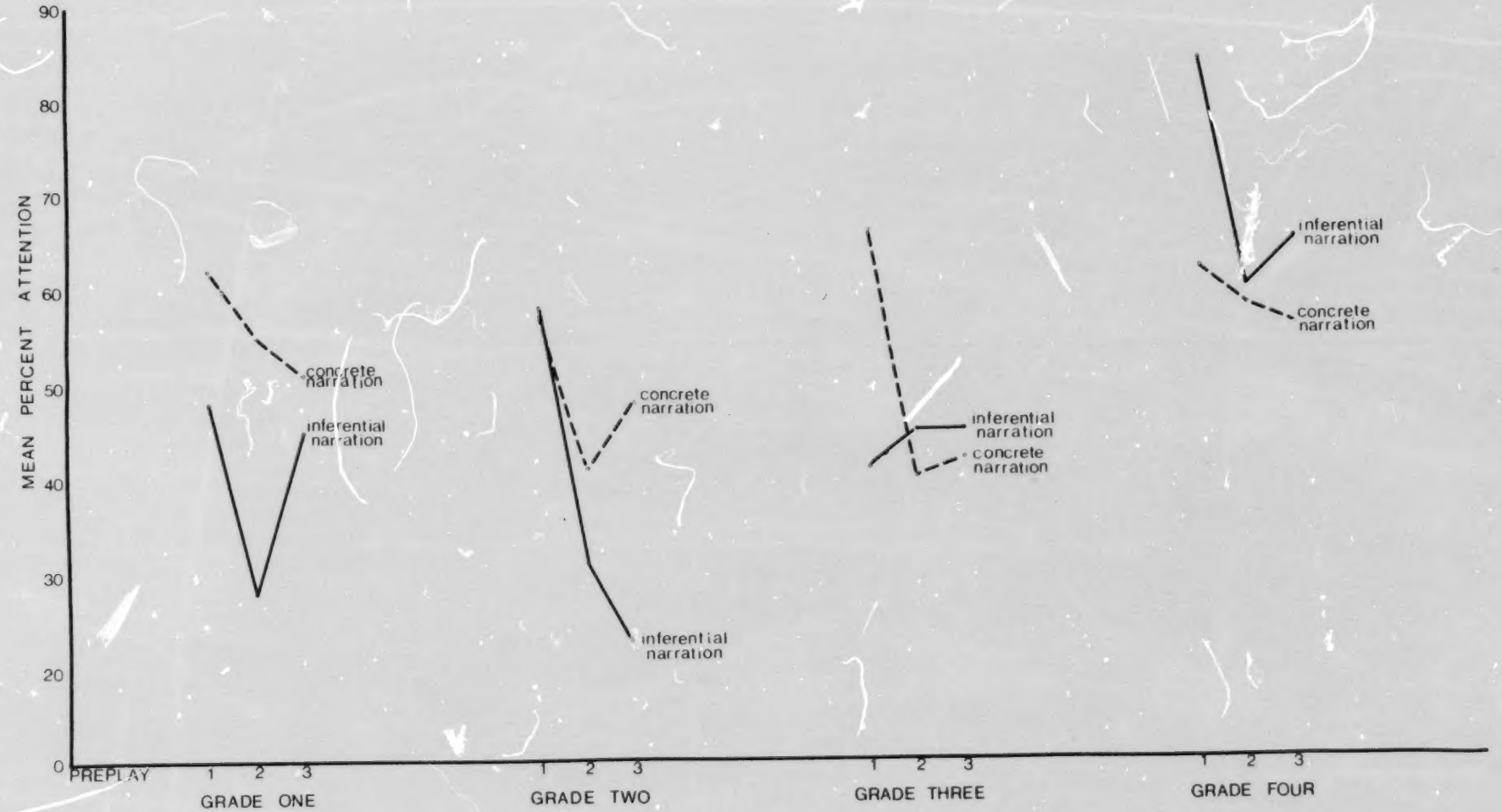
*$p < .05$.

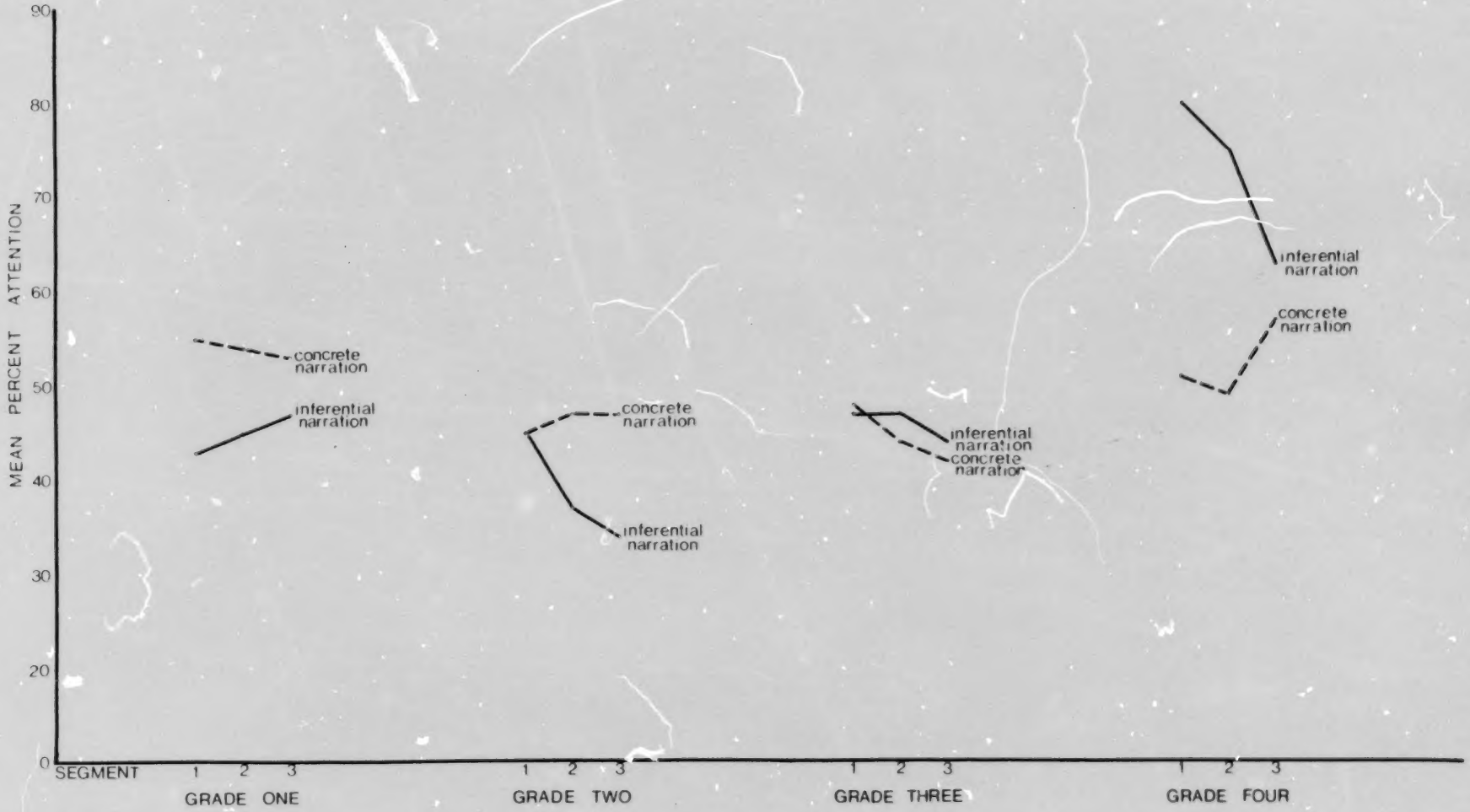
Figure Captions

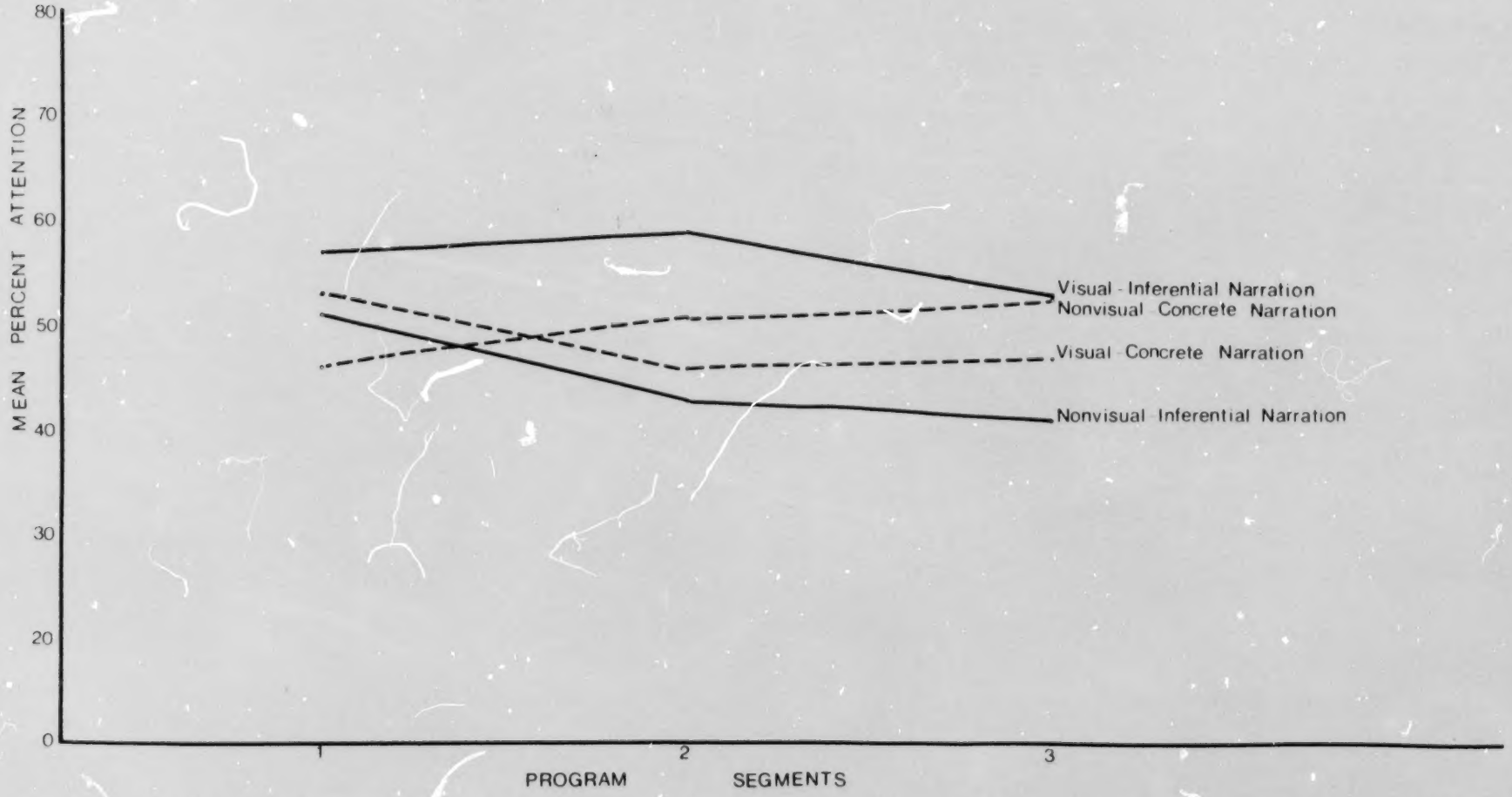
Figure 1. Mean percent attention to preplays as a function of verbal narration and grade.

Figure 2. Mean percent attention to program segments as a function of verbal narration and grade.

Figure 3. Mean percent attention to program segments as a function of verbal narration and visual presentation.


MEAN PERCENT ATTENTION
90
80
70
60
50
40
30
20
0
PREPLAY
1
2
3
concrete narration
inferential narration
GRADE ONE
GRADE TWO
GRADE THREE
GRADE FOUR


MEAN PERCENT ATTENTION
90
80
70
60
50
40
30
20
0
SEGMENT
1 2 3
GRADE ONE
concrete narration
inferential narration
1 2 3
GRADE TWO
concrete narration
inferential narration
1 2 3
GRADE THREE
inferential narration
concrete narration
1 2 3
GRADE FOUR
inferential narration
concrete narration


MEAN PERCENT ATTENTION
80
70
60
50
40
30
20
0
1
2
3
PROGRAM SEGMENTS
Visual-Inferential Narration
Nonvisual Concrete Narration
Visual Concrete Narration
Nonvisual Inferential Narration